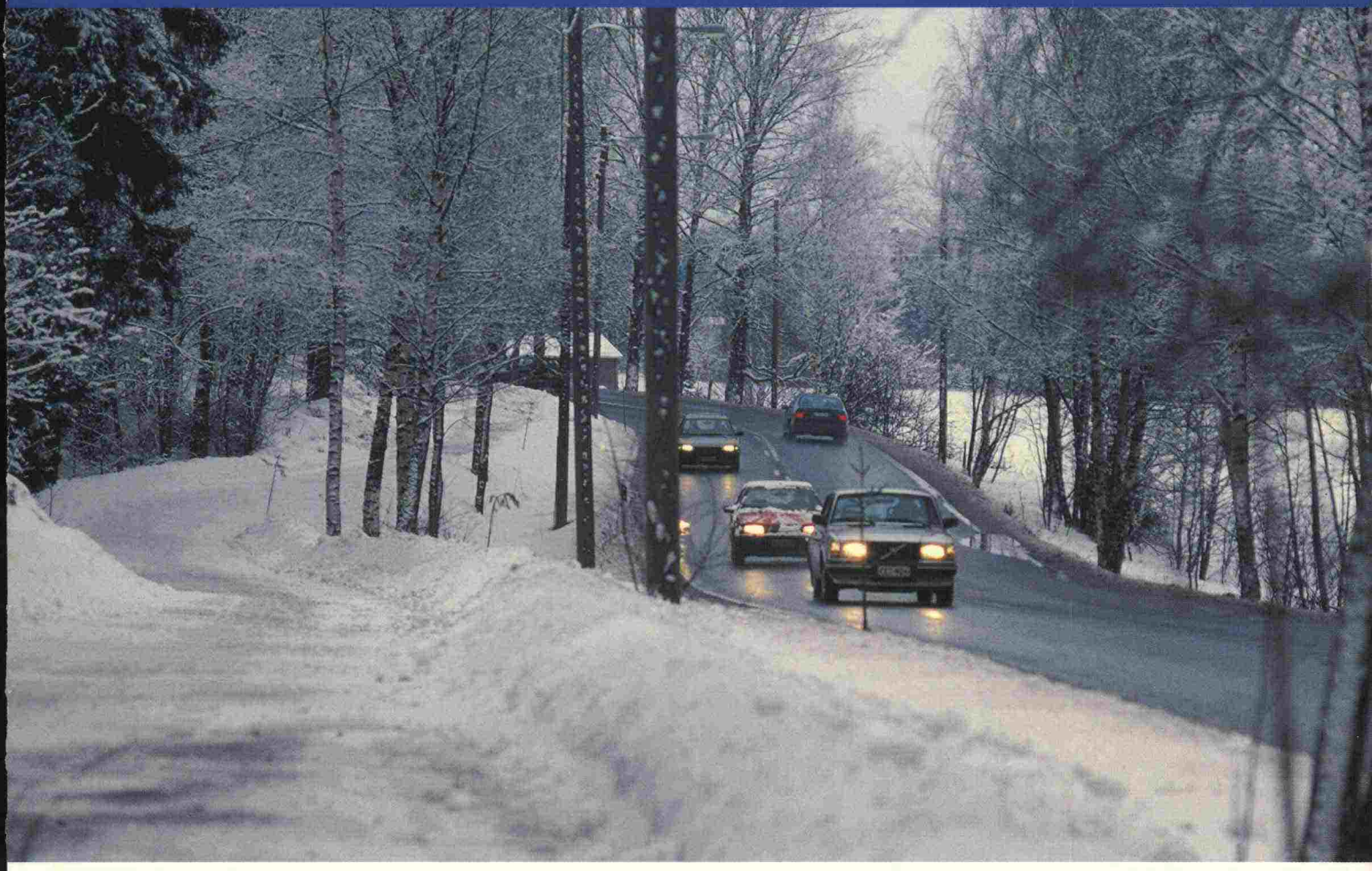
FINNISH ROAD ADMINISTRATION

Winter Maintenance Policy in Finland 2001 -



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Helsinki 2001

Photograph: Olli Penttinen

ISBN 951-726-746-0
TIEH 1000035E

Edita Oy
Helsinki 2001

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FINNISH ROAD ADMINISTRATION

245/2001/20/1

24.4.2001

RECIPIENT
Districts

LEGISLATIVE BASIS

REPLACES
"Winter Maintenance Policy in Finland", TIEL 2230014E

FOCUS
Road administration

EFFECTIVE
1.10.2001 until further notice

KEYWORDS
Winter maintenance, policy, services, quality

Winter road maintenance, policy 2001

The Road Administration's executive team approved this winter maintenance policy on January 30, 2001 to be taken into use and to be used as a basis for the quality standards and quality plans of regional contracts beginning in the autumn of 2001. This policy comprises the basis and state of intent on which winter maintenance will be based in the near future. The districts will apply and implement this policy, taking regional and local needs into consideration, in such a way that the level of service and quality experienced by road users at the borders of the districts and contract areas are as uniform as possible.

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FOREWORD

This winter maintenance policy describes the principles and guidelines according to which winter maintenance of public roads is to be implemented and wintertime traffic ability is to be guaranteed. This policy defines the wintertime level of service of the road network and the quality standards required to describe that level. This policy also describes the objectives, decisions and expectations that gave rise to and affect the main guidelines. This policy uniformly applies to the entire country, but it is to be adapted to the regional and local needs and conditions of different parts of the country according to an agreed operating principle.

Separate, more detailed quality standards have been compiled in accordance with this policy. They function as the quality standards of winter maintenance contracts. This policy is also applied to the quality plans that are an integral part of contracting, and which together with the quality standards have a significant role in the implementation and verification of the quality outlined in this policy.

This policy was compiled as part of the Road Administration's road and traffic conditions planning process. It takes into account the latest guidelines of the Ministry of Transport and Communications concerning traffic. A seminar was arranged for interest groups in conjunction with the compilation of this policy. It also takes into consideration earlier feedback received from interest groups when overall road management policy was being planned.

This policy was compiled by the Road Administration's internal work group: Matti Höyssä, Jukka Jääskö, Jukka Karjalainen, Heikki Lappalainen, Anne Leppänen, Olli Penttinen, Juha Salmenkaita, Aki Tarkkanen, Saara Toivonen and Hannu Tolonen.

Helsinki, April 2001

Road Administration
Strategic Planning

Contents

1 INTRODUCTION

This winter maintenance policy is part of road management strategic planning. It defines the wintertime level of service of the road network from the standpoint of winter maintenance. Winter maintenance of the entire public road network is based on this policy and the principles presented herein. It is applied in different parts of the country according to local conditions and traffic needs. The aim is to achieve uniform quality on the main road network. Nevertheless, because of the effects of different climate in different parts of the country, the level of service and driving conditions experienced by road users may differ in different parts of the country.

The quality standards presented in this policy are defined in more detail as separate quality standards. Local adaptations and special needs are recorded as job-specific details in local contracts. These quality standards and job-specific details function as contractors' quality specifications. Winter maintenance is a form of service that hinges to a great degree on time and the weather situation. Thus, all aspects cannot be fully described by means of quality standards. It is important that practical operation follows good principles, and contractors are customer-oriented in striving to meet the objectives outlined in this policy. Because practical work is carried out in rapidly changing weather conditions, relying on forecasts, it is important that Road Management is able to trust the contractor who is responsible for the work and that the contractor is familiar with the objectives, operating principles and operating procedures of winter maintenance. These are presented in the contractor's quality plan.

The current length of the public road network is about 78,000 km. During the term of this policy no changes are expected in the road network or in road management responsibility that would have a significant impact on winter maintenance. Traffic is expected to grow at an annual rate of about 1.5 %. Traffic will increase the most around growth centers and on the main roads in the south. This increase will cause a rise in the proportion of the road network placed in the highest maintenance class. As the road network improves, road length and the managed surface area will expand somewhat.

Winter maintenance has a significant effect on the functionality of the entire transportation system. Traffic volume during the six winter months is around 44 % of the year-round volume. In many fields of industry and commerce the share of transports taking place in the winter months is greater than that in summer. Communities, industry and commerce that depend on transports and road traffic expect transportation to function reliably all year round.

Long-term road management policy (Road management policy 2015) is based on the premise that the level of road maintenance in general will be kept at the present level. This level of maintenance will be guaranteed even though the overall financing or cost level of road management changes. The main goal is to improve the yield of winter maintenance so that although traffic and the road network grows, the resulting increased need for maintenance can be taken care of with less effort than is expended today.

This policy is based on current traffic regulations, for example, regarding winter tires and studded tires, in particular. It also assumes that the use of road salt to combat slipperiness will continue to be possible.

2 BASIS AND EXPECTATIONS OF WINTER MAINTENANCE

2.1 Currently effective policies and decisions

The planning of winter maintenance policy is based on the following documents and decisions:

"Toward intelligent, sustainable transportation 2025", a document approved by the Ministry of Transport and Communications (2000), presents long-term objectives set for transportation. The appendix of this document contains a summary of how this winter maintenance policy corresponds to the transportation objectives.

The long-term road management policy **"Road management policy 2015"** proposes that day-to-day maintenance of the road network should be kept at the current level, and that this level should be guaranteed above all even in the event of a change in financing. The plan emphasizes impartiality toward different modes of travel and travel conditions. Planning of maintenance procedures increasingly involves cooperation between different organizations. The main areas of impact are economy (benefits for society and the efficiency of our own operation), road safety and responsibility for the environment.

The **Road safety plan 2001-2005** approved by the Ministry of Transport and Communications requires winter maintenance to reduce the number of head-on collisions. The plan proposes that winter maintenance of main roads should be improved in the coastal areas, especially during changes in weather. According to the plan the 80 km/h winter speed limit would be extended to cover all two-lane roads with the exception of certain sections of road in northern Finland. The plan also emphasizes the significance of distributing information about driving conditions. The **Government decision in principle concerning road safety improvement** (2001) proposes that if road safety does not improve sufficiently, extension of winter speed limits should be considered.

The **"Transportation policy and environmental questions"** document compiled by the Ministry of Transport and Communications includes issues that are also connected to winter maintenance. It proposes that the total amount of road salt used to combat slipperiness should be reduced to 70,000 tons by 2003. Various parts of the policy have at least an indirect impact on winter maintenance:

- greenhouse gasses, fuel economy → impact on driving conditions
- pedestrian and bicycle traffic conditions → also winter traffic
- use of natural resources → sand used for road sanding
- safe transport of dangerous materials → level of service
- susceptibility to noise → work machines in built-up areas at night

The goal of the **Government decision in principle concerning water protection objectives by 2005** is that the quality of groundwater will remain at least as good as it is today, but will improve where earlier activity has worsened it. The decision proposes that anti-slipping procedures should not harm

groundwater or surface water, and procedures that decrease the amount of harm done should be planned by 2002.

According to **§ 12** of the current **Road Law**, "public roads shall be kept free of snow and ice obstacles as required by motor vehicle traffic". According to the law, Road Management may leave certain sections of road with little traffic without winter maintenance.

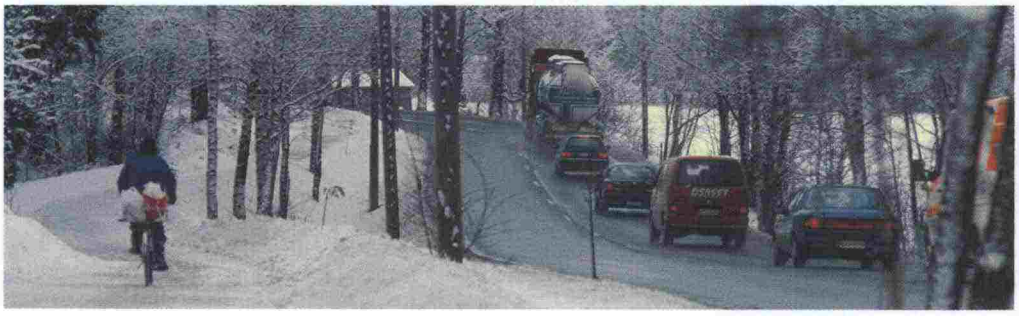
According to **§ 23** of the **Road Law**, the speed of a motor vehicle shall be adjusted to a safe level, taking into consideration the condition of the road, the weather, driving conditions, visibility and traffic conditions.

The Supreme Court has adopted a position on liability related to anti-slipping procedures in its decisions during the past few years. All in all, recent case law has indicated that the road manager's liability has increased, especially in the case of pedestrians (and bicyclists) who use pedestrian and bicycle paths. Decisions dealing with motor vehicle traffic also specify the liabilities of the road manager and driver in more detail. As a rule, the contributory negligence of the driver is emphasized in cases of slipperiness. However, the road manager should strive to prevent exceptional changes in driving conditions and avoid borders between maintenance areas that a driver encounters suddenly and unexpectedly, and which a careful driver cannot be expected to be prepared for.

2.2 Expectations of winter maintenance

National and regional organizations cooperating in road management emphasize the significance of good traffic conditions from the standpoint of national and regional development. Winter road maintenance is of major significance in guaranteeing traffic conditions. The role of the main roads as the country's main traffic and transport artery is held very important. The safety of the main roads is seen as a very significant issue.

Ensuring the traffic ability of the lower class road network and maintaining the functionality of transportation is necessary from the standpoint of people's day-to-day travel, mass transport, industrial and commercial transport, business operation and service provided by society. Many road user organizations also emphasize a sufficient level of service on quiet roads. They want it to be better than it currently is (during the past few years). Special attention is given to anti-slipping procedures.



Road users feel uniform, predictable driving conditions are important. This is important for the sake of safety and the reliability and predictability of trans-

porting, in particular. Because long-distance transports mainly take place at night and they are increasingly tied to schedules, sufficiently good conditions are necessary 24 hours a day. There is a call for investing in quick reaction time, which eases problem situations.

2.3 Most recent research findings

The scientific viewpoint on winter maintenance and its effects has not changed significantly since the previous policy was taken into use. The outlook on road safety, environmental impact and winter traffic from the road user's viewpoint has become more detailed.

The latest road safety studies indicate that wintertime and summertime safety risk levels have approached each other, and they are at nearly the same level, on average. Nevertheless, wintertime risks are still higher on the busy main roads in the coastal areas. Research findings indicate that with the current level of funding it is not possible to clearly raise the level of road safety by means of winter maintenance procedures. But, the level cannot be allowed to get any lower, either. The responsibility of the driver is emphasized even more. This fact is supported by the observation that nearly half of wintertime accidents resulting in death take place when it snowing or sleeting, at which time the entire maintenance fleet is in operation.

Because the number of accidents is linked to the total amount of traffic, and maintenance procedures on the main roads effectively affect a large portion of traffic, guaranteeing road safety is focused on the main road network. According to research, the uniformity and predictability of driving conditions are most important. Most head-on collisions, which occur more often in winter, take place in situations when the weather is changing.

Pedestrian and bicycle falls result in significant costs to society, even when compared with motor vehicle accidents. About 70,000 falls per year occur in pedestrian and bicycle traffic. Only about 1 % of these take place on the pedestrian and bicycle lanes of the public road network. From the viewpoint of cost to society, it is worth keeping pedestrian and bicycle paths in good enough condition to reduce the number of falls. The current level of maintenance on routes for which Road Management is responsible is high enough with respect to the amount of traffic on them.

According to studies, salt has a significant effect on groundwater and the condition of groundwater basins. At the end of the 1990s the chloride content in about half of the groundwater areas within salted areas was rising and in half it was falling. The effect of salt is very dependent on the locality. For this reason, to decrease the impact on groundwater areas it is most important to pay attention to controlling the situation in each groundwater area instead of the total amount of salt used. The most effective method is to implement focused limitations on the use of salt in groundwater areas.

3 OBJECTIVES AND POLICIES

The purpose of winter maintenance is to ensure the functionality of transportation in winter. The level of winter maintenance has a direct, far-reaching impact on all of people's and society's functions that are linked to day-to-day travel on roads and pedestrian and bicycle paths and on transporting on the road network. An increasingly significant share of transports are linked to time in the logistical sense. The predictability of travel times is also important in winter. Nearly nowhere in society's activities are operating rhythms or schedules divided into winter and summer rhythms. Traffic and transport are expected to function well in both winter and summer. Society is expected to guarantee the prerequisites for basic travel during the times when society's other activities are also functioning.

The objectives set for winter maintenance should clearly be based on society's activities, and operation should be flexibly controlled according to those needs. This focuses attention on the significance of regional and local flexibility in specifying the level of service of winter maintenance.

Winter maintenance observes the following policies and operating principles:

Uniform, regionally equal prerequisites for travel throughout the country.

The same possibilities for travel are provided throughout the country. Uniform principles of categorizing road maintenance and uniform quality standards are observed throughout the country. Nevertheless, common principles are adapted according to regional and local needs and conditions. Especially differences in climate are taken into consideration.

A uniform level of service on connecting traffic routes.

Regardless of administrative borders, contract areas or different traffic volumes, the level of service of the road network should be kept sufficiently uniform along connecting traffic routes from the standpoint of the road user. Maintenance area borders should be located logically from the viewpoint of traffic. From the standpoint of a uniform level of service it is important that real-time cooperation and distribution of information works between different contractors and contract areas. In any case, regional differences in climate and changes in the weather bring natural variation to driving conditions.

Maintenance of main roads according to climate areas.

Winter climate differs in coastal areas and further inland. This affects changes in driving conditions, anti-slipping procedures, especially salting, and the possibility to maintain sufficiently good winter driving conditions.

Maintenance categorization in different climate areas is adapted according to the demands of each area's climate. Less salt is used inland and more wintry driving conditions more often prevail on the road network. Salt is used to keep the main roads bare in the coastal area.

The level of service is focused and controlled according to location and time, while taking the demands of traffic and the condition of the road network into consideration.

Even on similar roads, the demands of traffic vary with time and location. Conditions affecting travel, the road network and winter maintenance also vary, as do local traffic needs. This should be adequately taken into consideration when adapting this policy. The amount and role of heavy traffic and public transport routes should be taken into consideration when deciding the maintenance class and specifying possible road-specific quality standards.

The demands of traffic should always be anticipated and implemented to minimize the need for real-time requests for service. Momentary requests for service and maintenance procedures are implemented in emergency and problem situations.

Winter maintenance guarantees the best possible wintertime road safety and expected driving conditions.

Winter and the level of winter maintenance have a significant impact on road safety. The basic principle is that the wintertime road safety risk is no higher than during the rest of the year. Because winter naturally worsens driving conditions on the road network, it is important from the standpoint of road safety that the level of maintenance is as uniform and predictable as possible. Unexpected borders and other variations that lower the quality level should be avoided.

Wintertime road safety requires matching the level of maintenance with speed limits. The road manager should also help road users anticipate risky, exceptional conditions by providing information about driving conditions.

The level of service is specified cost-effectively. Roads with little traffic have a basic level of service.

From the viewpoint of efficiency and good effectiveness, the quality level and amount of maintenance are graded according to road use. The intent is to achieve the best possible cost-benefit ratio on the road network. A basic level of service that allows 24-hour travel is guaranteed on quiet roads. However, travel may become significantly more difficult during exceptional weather conditions, which may occur a few times per winter.

Maintenance of the road network and its parts adheres to the principle of social fairness.

Road user categories and the routes and parts of routes that serve them are given equal status when defining the level of quality. The level of quality following maintenance procedures also allows disabled persons to travel along pedestrian and bicycle paths. Sufficiently good maintenance of pedestrian and bicycle paths and bus stops promotes the role of pedestrian and bicycle traffic. The demands of pedestrian and bicycle traffic are taken into consideration in maintaining the shoulders of the roads.

Environmental hazards are reduced. The use of salt is limited in groundwater areas.

Road salt affects the quality of groundwater. Sand increases the formation of dust and its use affects the amount of unrenewable natural resources. The total amount of salt used is reduced by revising the maintenance classes of the road network. Contractors are required to have knowledge and be precise in the use of salt, so that as little salt as possible is used, but keeping road safety in mind.

Groundwater risk is reduced especially by locally reducing the use of salt in sensitive groundwater areas. At the same time road safety and smooth traffic is guaranteed using alternative means such as a good level of service and local speed limits.

The benefit of sanding is increased and the disadvantage of dust in built-up areas is decreased through the correct selection of the sanding material.

The Road Administration as the orderer specifies the level of service and ensures that contractors keep the roads at the agreed quality level.

It is important to ensure that the intent and content of this winter maintenance policy and the quality standards based on this policy are known and taken into consideration throughout the entire chain of operation from the orderer to the employees of the contractor. The goal is that the responsible contractor is service-minded in acting for the best of the road users. From the standpoint of guaranteeing the level of service it is important that contractors are continuously aware of developments in the weather and driving conditions and the condition of the road network.

Providing road users with information improves their chance of affecting their own safe, smooth wintertime traveling.

Traveling in winter conditions requires adaptation of driving and travel habits in all situations and preparation according to the weather and driving conditions. Providing information related to winter traffic boosts road users' own chances of acting safely and responsibly. Providing information about the weather and driving conditions ensures that as many people as possible on the road are aware of prevailing and expected driving conditions and that they will take this information into consideration when planning trips and transports and when actually traveling.

In the document "Toward intelligent, sustainable transportation 2025" the Ministry of Transport and Communications presents the objectives of traffic and related general objectives. These objectives and the manner in which winter maintenance responds to them are presented in Appendix 1.

4 LEVEL OF SERVICE ON THE ROAD NETWORK

A uniform level of service and a classification describing are used throughout the country. The level of service is mainly defined according to traffic volume, the road's functional class and the regional climate.

The road network is divided into five main maintenance classes (Is, I, Ib, II, III). In addition, class Ib has a corresponding maintenance class T-Ib for built-up areas. Each class has a different level of service and quality standards. Road classes are defined by connecting route in such a way that they function logically from the road user's point of view, and differences in quality do not cause unexpected situations. In deciding the maintenance class of a road not only are the classification criteria taken into consideration, but also local conditions, the nature and composition of traffic, the speed limit and qualitative integration with the level of service of the municipality's road network.

Because maintenance procedures are mainly implemented as continuous maintenance loops, road classes should be logical also from the viewpoint of road maintenance. This way winter maintenance can be implemented as economically as possible.

Pedestrian and bicycle paths are divided into two maintenance classes (K1, K2). This way the procedures of different routes can be timed to serve traffic on the route as well as possible at the correct time, especially commuting traffic, routes to public transport, schools, day care centers and services.
The road network is divided into maintenance classes as follows.

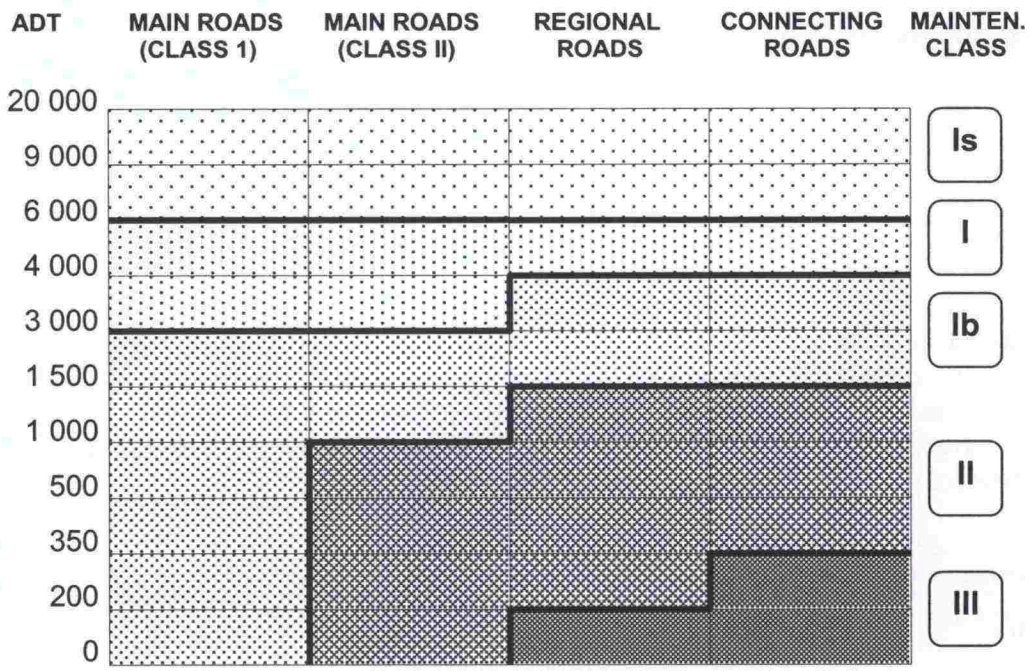


Figure 1. Division of the road network into winter maintenance classes.

Level of service in different maintenance classes

Maintenance class Is
The road is bare most of the time. In central and northern Finland and during cold periods in the south the road may contain thin longitudinal strips of packed snow that do not particularly affect driving. During long periods of very cold weather when salt cannot be used the road may be partly icy. Slipperiness is prevented mainly by means of anticipatory procedures.

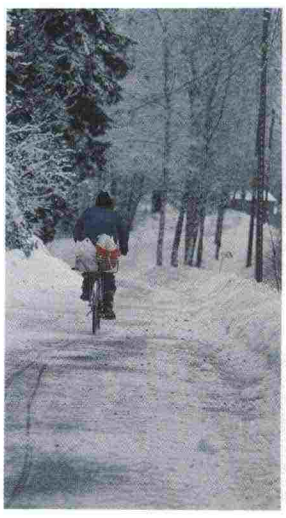
Maintenance class I
The road is bare most of the time or it may contain low, thin strips of packed snow between the lanes and ruts. The road may be slightly slippery during changes in the weather and at night. Problem situations caused by slipperiness are prevented by using anticipatory anti-slipping procedures.

Maintenance class Ib
The road is maintained at a high level, but mainly without using salt. Depending on the amount of traffic and the weather, the surface of the road is partly bare, it may partly contain strips of packed snow or it may be completely covered with packed snow. Except for problem situations, the road is in good winter driving condition that is slightly slippery, but sufficiently safe if road users take prevailing conditions into consideration. The packed snow and ruts in it are leveled as evenly as possible. Slipperiness is prevented only in early and late winter and in exceptional problem situations.

Maintenance class TIb (built-up area)
The road contains packed snow in the middle of winter. The quality is similar to that of class Ib roads, except that ruts in the packed snow may be deeper, but because of the lower speed limit they do not cause problems for traffic.

Maintenance class II
The surface of the road contains packed snow, or depending on the amount of traffic, the packed snow may partly contain ruts. In normal situations the friction and evenness of the road is sufficient for careful travel. Intersections, hills and curves are sanded to make travel safe in normal situations. The entire road is sanded in problem situations. Carefulness is expected of traffic in difficult weather, such as sudden mildness or immediately after a snowstorm.

Maintenance class III
The road contains packed snow and some ruts most of the time. In very cold weather driving conditions are satisfactory, but they may vary in places. During changes in the weather driving conditions may be problematic for several hours, and drivers have to be especially careful.



Pedestrian and bicycle paths

K1
The path is maintained in the morning before commuting traffic begins and is well maintained to serve leisure time traffic in the evening and on weekends. The level of service allows biking and travel with a baby carriage, wheelchair or walker.

K2
The path usually also has some commuting traffic. The quality level after maintenance procedures is the same as that of K1 paths, but the quality level resulting from later maintenance procedures varies.

Normal maintenance classes are primarily used in built-up areas. In built-up areas where traffic differs from the rest of the road network in the maintenance class due to special circumstances in the built-up area, a lower speed limit, different modes of travel or different types of trips, the quality standards of the maintenance class are modified to better meet the needs of traffic or the nature of the built-up area. The use of salt should be avoided on routes in built-up areas.

For the purpose of uniform practice, the quality level of the maintenance class of the road in question is modified for the same reasons. A built-up area on a class I or Ib road is normally maintained according to class T-Ib. This class is used in an area indicated by a built-up area sign or a specifically designated section of road. This class is not used on by-pass roads or in situations where a different class is not necessary from the standpoint of traffic or built-up area activity.

On especially busy roads (ADT > 20 000 vehicles/day), where traffic volume is large nearly 24 hours and on weekends, the level of maintenance and the timing of procedures are assigned special requirements. They especially affect busy access roads and by-passes in the Helsinki area. Due to the large amount of traffic, the use of salt may depart from the temperature limits of salting, if necessary.

Focusing maintenance according to special traffic needs

Precision maintenance
If special traffic needs so require, maintenance methods, timing or quality on specific sections of road may be modified locally without changing the maintenance class. Only a limited number of these precision maintenance sites are specified. They are presented as job-specific details in regional contracts and included in the district's common winter maintenance plan. Precision maintenance sites are specified based on the following principles:

- The volume or vehicle composition of traffic differs from normal on a specific section of road or a connecting route over a limited period so much that quality should be modified. Such situations are special or separate transports, crowded public events and peak traffic at sports events.
- Deviating timing of traffic requires a change in the maintenance schedule.
- Deviating or dominant traffic direction requires a change in the order of maintenance procedures.

Holiday quality
The spirit of serving and customer orientation of winter maintenance calls for ensuring a good level of maintenance at times when the road network has an abnormally large amount of traffic or the nature of the traffic differs from normal. Such cases are the traffic peaks at Christmas, New Year's, Easter

and ski vacation. Traffic at these times is long-distance traffic. People are driving in strange surroundings, less people in traffic are experienced winter drivers, and traffic is bound to time. Precision maintenance at these times focuses on departing and returning traffic on the most important main road network (trunk network) and connecting routes specified by the districts.

Holiday quality refers to implementing certain normal procedures in anticipation before traffic peaks and good maintenance readiness in case of changes in the weather. From the standpoint of good customer service it is important that the road is well plowed, including the shoulders, parking areas, intersections and bus stops. It also means packed snow is leveled, spot sanding areas are sanded, signs and edge posts are cleaned before traffic peaks.

5 DESCRIPTION OF QUALITY AND MAINTENANCE

The most important maintenance quality standards are described in the following. They give a general picture of the level of quality of the lanes and the differences between maintenance classes. The quality standards are presented in more detail in a separate publication, "Teiden talvihoito, laatuvaatimukset 2001". The quality standards pictured here only refer to the actual lanes.

The quality of winter maintenance is specified using the following factors:

- **friction** (the friction scale 0.00 - 1.00 is linked to a description of driving conditions)
- **friction temperature limit** (the friction requirement on salted class Is and class I roads is lower below the temperature limit for salting)
- **maximum snow depth** (maximum depth of snow and slush when it is snowing)
- **plowing threshold** (maximum depth of snow and slush before plowing is started)
- **evenness** (ruts and unevenness in packed snow)
- **cycle time** (time from the moment quality becomes inferior or it stops snowing to the moment maintenance procedures are completed)
- **effective period of quality standards** (day / night).

At night, outside the effective period of the quality standards (22-05 or 22-06), the quality standards of the next lower class are followed. The effective period can be extended according to local needs.

Anti-slipping procedures

Table 1. Quality standards of anti-slipping procedures

QUALITY STANDARDS OF ANTI-SLIPPING PROCEDURES							
Winter maintenance class	**Is**	**I**	**Ib and TIb**	**II**	**III**	**K1**	**K2**
Normal	**0.30**	**0.28**	**0.25**	**according to traffic demands**	**according to traffic demands**	**according to traffic demands**	
Friction requirement	road surface below -6 °C **0.25**	Road surface below -4 °C **0.25**	spot sanding **0.25** line treatment **0.20-0.22**				
At night	22 - 05 **0.28**	22 - 05 **0.25**	22 - 05 as needed	22 - 06 as needed	22 - 06 as needed	after 22 K1 by 05 K2 by 06	
Cycle time	**2 h**	**2 h**	salt **3 h** sand **4 h**	**6 h** line sanding	**10 h** line sanding	**2 h**	

Table 2. Correlation between friction values and driving conditions

Friction value	**0.00 – 0.14**	**0.15 – 0.19**	**0.20 – 0.24**	**0.25 – 0.29**	**0.30 – 0.44**	**0.45 – 1.00**
Description of driving conditions	bad driving conditions, wet ice, **very slippery**	Icy, **slippery**	tightly packed snow, **satisf. winter conditions**	rough, packed ice and snow, **good winter conditions**	bare and wet, **not slippery**	bare and dry, **not slippery**

- The friction requirement must be met on at least half of the surface area of the lane.
- The friction requirement of class Is and I roads is 0.25 when the temperature of the road surface is lower than the limit value.
- Freezing situations in class Is and I are combated using anticipatory salting to prevent slipperiness or to at least minimize its duration and hindrance.
- At night, outside the effective period, the friction requirement is 0.28 for class Is and 0.25 for class I.
- In class Ib the friction requirement is 0.25 in early and late winter.
- During stable winter conditions class Ib requires sufficient anti-slipping procedures when the friction value drops below 0.25. The entire length of the road must be treated no later than when the friction value is expected to drop below 0.20. On specified busy Ib roads the entire length of the road must be treated no later than when the friction value is expected to drop below 0.22.
- In maintenance class TIb (built-up areas) salt is used as necessary only in early and late winter.
- In classes II and III sufficient friction needed by traffic is required.
- In class II regular anti-slipping procedures are implemented at problem sites, so traffic ability is guaranteed in all conditions. The entire length of the road is sanded during particularly difficult driving conditions.
- Anti-slipping procedures in classes II and III are supplemented by roughening the surface of packed snow.
- In class III particular problem sites are spot sanded to keep the road in trafficable condition. The entire length of the road is sanded during especially difficult driving conditions.

Snow and slush

Table 3. Quality standards for snow removal

QUALITY STANDARDS FOR SNOW REMOVAL							
Winter maintenance class	**Is**	**I**	**Ib and TIb**	**II**	**III**	**K1**	**K2**
Maximum snow depth when snowing	**4 cm**	**4 cm**	**4 cm** (8 cm at night)	**8 cm** (10 cm at night)	**10 cm** (10 cm at night)	**3 cm** (8 cm at night)	
Cycle time, clean after snowing stops	**2.5 h (slush 2 h)**	**3 h (slush 2.5 h)**	**3 h**	**4 h**	**6 h**	**3 h**	**4 h**
If snowing stops after 22 at night	**Plowed clean within cycle time**		**05** or cycle time	**06** or cycle time	**06** or cycle time	**05**	**06**

- The maximum snow depth must not be exceeded while it is snowing or during maintenance procedures thereafter.
- Only half as much slush is allowed as snow.
- Plowing must be started no later than when half of the maximum amount of snow has accumulated. This starting threshold is not used at night in classes II, III and K. In class Ib and TIb the starting threshold at night is 4 cm.
- The maximum amounts of snow refer to normal snowfalls. In exceptional snowstorms (a few times a year) these values may be exceeded.
- Snow depth refers to the prevailing situation in the lanes, including snow piled by traffic.
- Drifted snow is removed within the cycle time so it does not hinder traffic.

Surface evenness

Table 4. Quality standards for surface evenness

QUALITY STANDARDS FOR SURFACE EVENNESS							
Winter maintenance class	**Is**	**I**	**Ib and TIb**	**II**	**III**	**K1**	**K2**
Evenness requirement	**-**	**1 cm**	**1.5 cm (TIb 3 cm)**	**3 cm**	**3 cm**	**2 cm hindering**	
Cycle time	**1 day**	**1 day**	**1 day**	**2 days**	**3 days**	**12 h**	

- The evenness requirement refers to the maximum depth of ruts and unevenness in packed snow.
- In very cold weather when salting is not possible, the evenness requirement of maintenance class Is is 1 cm.
- The evenness requirement means the rut is not steep-edged (classes I and Ib). In other classes, including TIb the edge may be max. 10 mm.
- Evenness must not become more than 1 cm worse than the requirement even during the cycle time.

The main requirements of pedestrian and bicycle paths are:

- Timing of maintenance, which prevents traffic from moving onto the road.
- Sufficient friction for safe travel.
- Snow barriers do not prevent biking and the use of baby carriages.
- Normal quality standards are effective in class K1 05-22 and in class K2 06-22. Maintenance procedures must be completed by 05 or 06 if the cycle time so requires.
- Outside the town plan area the edge of a wide pedestrian and bicycle path may be left unsanded for kicksled and toboggan use.
- The packed snow of a pedestrian and bicycle path immediately bordering the road should be kept level enough to prevent the traffic from moving onto the road.
- The surface of a plowed and/or evened pedestrian and bicycle path must be roughened.
- In spring slushy packed snow should be removed to facilitate biking.

6 VERIFYING THE IMPLEMENTATION OF THIS POLICY IN THE CONTROL PROCESS

From the standpoint of the implementation of this policy, it is important that the entire process from road management planning to traffic services aims for the same goal in accordance with a common guideline and common principles. The maintenance process does not include a clear-cut product planning phase. Instead, the product (service) is described in this policy, the quality standards, the contract agreement and the quality plan. It is also typical of winter maintenance that the product is not received until it is put into use. Thus, anticipative quality assurance is of major importance from the standpoint of the final product. Winter maintenance reporting includes reporting on the contract, its implementation, the implemented product (driving conditions / road quality) and customer feedback.

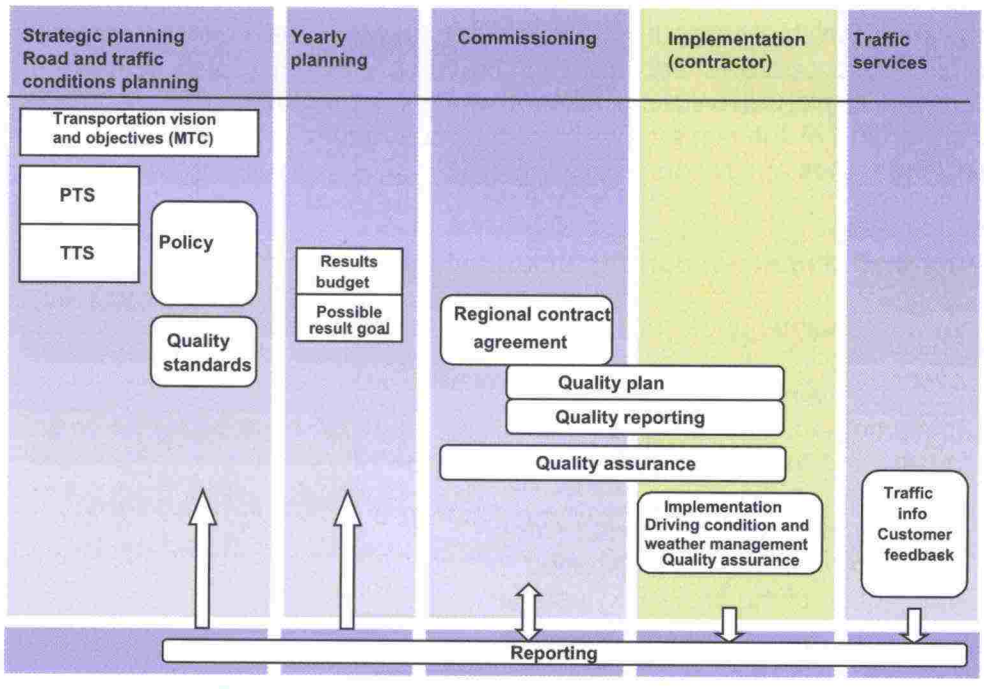


Figure 2. Phases of the control process of winter maintenance

Road Administration's quality assurance procedures

This policy describes the state of intent of road network maintenance. The main elements of assurance are the quality standards (general and job-specific), the quality plan, selection of a competent contractor and the contractor's skillful operation.

Winter maintenance operation takes place in real time in conformity with the weather and prevailing situations, and the orderer cannot control everything or receive completed work. The orderer should ensure the production of quality beforehand. Trust in the contractor's will, competence and skill is very important. On the other hand, it is important for the contractor to understand the content of the contract agreement and also the purpose of the procedures and the impact of the procedures on traffic. Regardless of the detailed quality specifications, many matters depend on the contractor's operation. Management of weather and driving conditions throughout the entire road network plays a major role. This affects the timing of procedures, which has a significant impact in the level of service and quality experienced by road users.

From the viewpoint of the implementation of this policy and the general and job-specific quality standards defined on the basis of this policy, it is important that the different organizations involved understand the requirements of winter maintenance, the spirit of operation and the desired results in the same way. This is especially important in quality-responsible contracting, which winter maintenance primarily is.

Because all the factors related to quality and qualitative operation cannot be described and controlled by means of quality standards, quality planning becomes even more significant. Striving toward service-oriented operation, well-timed management of situations, seamless cooperation between different contracts and environmentally friendly, safe activity is especially emphasized in the role and content of the quality plans. For this reason it is especially important to ensure by means of auditing that the entire personnel of the contractor operates according to the compiled quality plan. A more detailed quality plan also functions as a winter maintenance plan, which contains mention of the issues that have the most impact on the work, such as operating routes and resource allocation.

Winter maintenance reporting and quality monitoring

Post-winter maintenance control requires reporting on the following:

- costs by maintenance class
- implementation of contracts
- quality and the level of service on the road
- road user feedback
- description of wintertime road safety
- environmental impact information
- description of the prevailing weather.

A winter maintenance report based on the above is compiled within Road Administration at the contract, district and administrative levels.
From the standpoint of costs it is important to control costs by maintenance class. Only in this way is it possible to compare and control the price level of different areas.

Implementation of contracts (quality) is reported as the contract supervisor's (roadmaster's) personal evaluation and the number of deviation reports, complaints, penalties and bonuses.

The level of service and quality on the road is reported by means of quality monitoring based on random sampling. An annual study of the level of service also provides a general picture of the quality of winter maintenance and especially its development. Because statistically sufficiently extensive quality monitoring of the entire road network is difficult and expensive, this is of great significance, particularly regarding the lower-class road network. The evaluation provided by contract supervisors is also of great significance in level of service reporting.

Information acquired through the feedback system is mainly used in contract-specific control and monitoring. If system operation is well established, statistics compiled about feedback provide a general picture of road user satisfaction.

Environmental reporting monitors salt use by maintenance class and the total amount of sand used. The condition of groundwater areas near the road is monitored by means of regular, established measurements.

Reports on the prevailing weather are compiled monthly and annually. Weather reporting includes general weather monitoring, possibly a weather index and weather risk figures of contracts.

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Photographs

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8 APPENDICES

Appendix 1. How the winter maintenance policy corresponds to general transportation goals
Appendix 2. Operating environment of public road winter maintenance
Appendix 3. Ratio of wintertime and summertime personal injury accident risks
Appendix 4. Winter maintenance classification of class I and class II main roads

Appendix 1

How the winter maintenance policy corresponds to general transportation goals

This table contains the goals outlined in the Ministry of Transport and Communications document "Toward intelligent, sustainable transportation 2025" and describes how well winter maintenance corresponds to them.

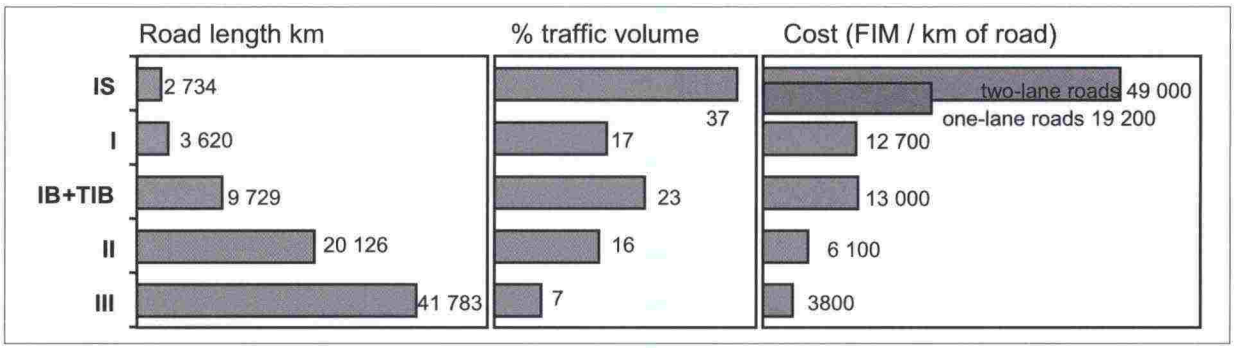
Objective area	Transportation goal	Winter maintenance policy, view or method
Level of service and costs	Travel and transporting is safe, qualitative and reasonably priced.	The level of service of travel in winter is good on the main roads, satisfactory or at least sufficient on other roads. Pedestrian and bicycle paths are maintained according to the needs of travel. Added costs to transportation due to the maintenance level are relatively minor.
	The basic level of service of travel is guaranteed throughout the country. The smoothness and reliability of passenger and freight transportation is guaranteed for both domestic and foreign transports.	Throughout the country, even roads with light traffic have a basic level of service that permits 24-hour travel. Travel becomes difficult in exceptional weather conditions. The goal of winter maintenance is a uniform level of service and predictable driving conditions, and thereby predictable travel times, especially on the main roads. Special demands of traffic are taken into consideration locally by timing maintenance procedures.
	Traffic information is real-time, reliable and easily usable information.	Traffic information supports and reinforces the effects of winter maintenance and the service provided to customers.
	Development and maintenance of the transportation system is cost effective.	The level of service is specified so clearly that bid requesting is efficient. The quality level of different road classes is defined at the correct level from the standpoint of society, while taking into consideration available funding, road class and the volume and nature of traffic.
	Traffic and transport markets are efficient and subjected to competition.	The maintenance level of traffic routes is fair to all road users.
	Domestic service production in the field of traffic and transport is competitive and it has good prerequisites for international operation.	

Objective area	Transportation goal	Winter maintenance policy, view or method
Safety and health	The transportation environment promotes and supports health.	The maintenance level of pedestrian and bicycle paths permits walking and biking to work, everyday business and leisure-time activities.
	No one needs to die or get seriously injured in traffic.	Road safety is a major goal in defining the level of winter maintenance. The intent is to reach a wintertime level of road safety equal to the summertime level. The level of pedestrian and bicycle paths permits safe travel especially after maintenance procedures.
Social sustainability	The advantages and disadvantages of traffic are focused fairly and reasonably among different population groups.	The winter maintenance level is defined fairly so the level of service corresponds to the general level of service of each part of the road network. Focusing of maintenance on different types and classes of routes is sufficiently fair regardless of the large differences in the number of users.
	The needs of people in a weaker position, in particular, are taken into consideration in traffic.	Pedestrian and bicycle paths in built-up areas have a sufficient level of service from the standpoint of elderly and disabled people. The maintenance level of the lower-class road network permits commuting traffic, regular school transportation and public transportation.
	People can participate in and influence planning that affects transportation solutions.	The districts actively survey local expectations and traffic needs. Regional expectations are taken into consideration in policies that affect the entire country. Road user feedback is taken into consideration when planning winter maintenance at the local level.
Area and community development	The transportation system supports national area use objectives and development strategies selected by the areas.	The winter maintenance level with respect to the road class is in correct proportion to the level of other service on the road. The level of service of winter travel is sufficient to support the development of different activities in the area.
	The transportation system supports goals related to the urban structure and town image.	
	Traffic and land use planning are integrated.	
	Travel surroundings are pleasant and safe.	Attention is paid to work methods and results of winter maintenance in cultural and scenic surroundings.
	The town image or cultural environment is not modified without substantial reasons.	
Detrimental environmental impact	Global and local detrimental environmental impact is as slight as possible.	The detrimental effect of salting on groundwater is being reduced by means of focused reduction measures. Groundwater shielding is one way to avoid detrimental effects on groundwater.
	Natural resources (such as energy, earth materials, land area, etc.) are used as little as possible.	Sanding is being developed with the goal of preserving gravel resources.

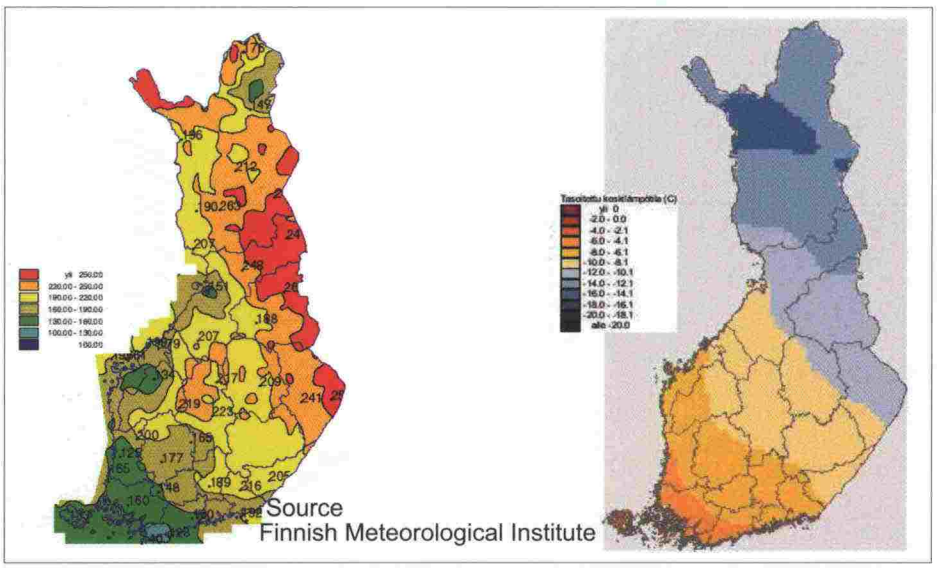
Appendix 2

Operating environment of public road winter maintenance

The following tables and figures contain approximate information about winter maintenance of the public road network, focusing of winter maintenance and climatic conditions.



Road lengths, traffic volume and approximate costs by maintenance class

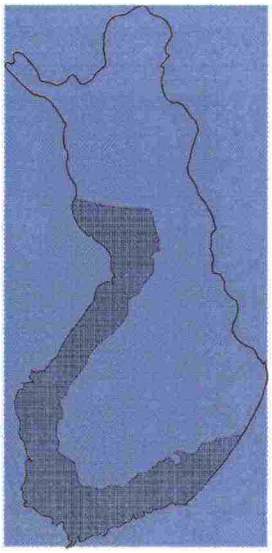


Amount of snow (mm) and average winter temperature (long-term avgs.)

- Winter maintenance costs are approximately 500-600 million FIM.
- About 35 % of the costs come from class I and II main roads and 65 % m from regional and connecting roads.
- About 60 % of the costs on average come from snow removal and surface evening and about 40 % from anti-slipping procedures. The figures vary significantly in different parts of the country and the road network.
- Winter maintenance is implemented as 99 regional contracts (2001-2004), where the length of the road network varies from 415 to 1 470 kilometers.

Appendix 3

Ratio of wintertime and summertime personal injury accident risks



Regardless of the incremental effect winter driving conditions have on accidents, the wintertime level of safety is quite near the summertime level. The situation is affected by:

- different driving habits in winter and summer
- winter speed limits
- the softening effect of plowed snowbanks on swerving accidents

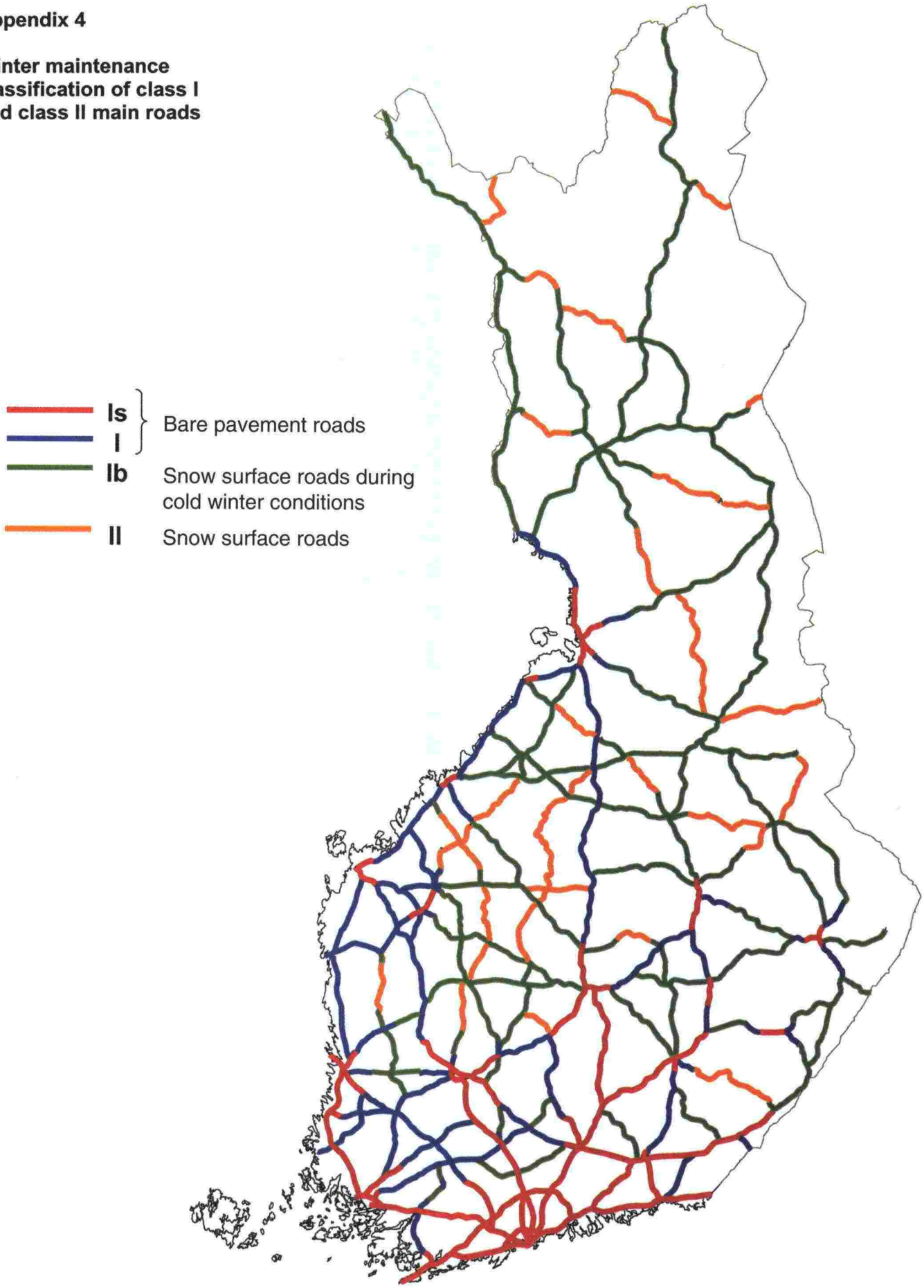
The following table presents the ratio between the wintertime (Oct.-Mar.) and summertime (Apr.-Sep.) risk of personal injury accidents in the country's coastal and inland areas. In the coastal areas, where winter weather varies more than elsewhere, the wintertime risk differs more from the summertime risk.

Ratio between wintertime and summertime risk of personal injury accidents (accidents / traffic volume). The larger the ratio, the greater the wintertime risk compared to the summertime risk. When the ratio is 1.00, the risks are equal.

	Wintertime risk / summertime risk 96-99		Wintertime risk / summertime risk 91-95	
	Coast	Inland	Coast	Inland
All accidents 96-99				
adt < 1500	1.33	1.31	1.26	1.29
adt 1500 - 6000	1.45	1.43	1.42	1.40
adt > 6000	1.36	1.41	1.41	1.35
total	1.39	1.38	1.37	1.35
Personal injury accidents 96-99				
adt < 1500	0.83	0.88	0.87	0.88
adt 1500 - 6000	1.00	0.98	1.09	1.04
adt > 6000	1.23	1.12	1.35	1.17
total	1.02	0.97	1.09	1.00
Deaths 96-99				
adt < 1500	0.78	0.89	0.85	0.95
adt 1500 - 6000	1.21	0.93	1.22	1.23
adt > 6000	1.02	0.90	1.56	1.07
total	1.03	0.91	1.10	1.09

Appendix 4

Winter maintenance classification of class I and class II main roads



ISBN 951-726-746-0
TIEH 1000035E